NuTool – Boot Loader ISP Tool User Manual

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller and microprocessor based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

Tabl	e of Contents	
1	OVERVIEW	4
2	FEATURES	4
3	SOFTWARE AND HARDWARE REQUIREMENTS	5
4	USER INTERFACE GUIDE	8
	4.1 Overview	
	4.2 Select Connection Interface	8
	4.2.1 USB Interface	9
	4.2.2 UART Interface	9
	4.2.3 SPI Interface	9
	4.2.4 I ² C Interface	
	4.2.5 CAN Interface	
	4.3 Connect with Boot Loader	
	4.4 Load File	11
	4.5 CONFIG Settings	
	4.6 Change the Baud Rate of Connection Interface	
	4.7 Reset Options	
	4.8 Programming Options	
	4.9 Programming	14
5	REVISION HISTORY	15

List of Figures

Figure 1-1 Block Diagram of Boot Loader ISP Process
Figure 3-1 Nu-Link2-Pro Overview5
Figure 3-2 Nu-Link2-Pro Bridge Connector
Figure 3-3 Set Boot Loader ISP Mode7
Figure 4-1 NuTool – Boot Loader ISP Tool Overview
Figure 4-2 Connection Interfaces
Figure 4-3 USB Interface9
Figure 4-4 UART Interface
Figure 4-5 SPI Interface9
Figure 4-6 I ² C interface
Figure 4-7 CAN Interface 10
Figure 4-8 Start Connecting 11
Figure 4-9 Succeed to Connect with Boot Loader 11
Figure 4-10 Waiting to Connect with Boot Loader 11
Figure 4-11 Load File 11
Figure 4-12 Data Display Area12
Figure 4-13 CONFIG Settings 12
Figure 4-14 Modified CONFIG Settings 12
Figure 4-15 Change UART Baud Rate 12
Figure 4-16 Change CAN Baud Rate 13
Figure 4-17 Reset Options 13
Figure 4-18 Programming Options14
Figure 4-19 Start Programming14
Figure 4-20 Programming Result 14

1 OVERVIEW

The NuTool – Boot Loader ISP Tool is a tool specially designed for NuMicro MCU series with Boot Loader ISP mode. The NuTool – Boot Loader ISP Tool can connect to Boot Loader of the target chip through various interfaces, such as USB, UART, SPI, I²C and CAN, to update the firmware of APROM and LDROM and modify the CONFIG settings.

The complete Boot Loader In-System-Programming (ISP) process consists of the NuTool – Boot Loader ISP Tool, the connection interface, and Boot Loader of the target chip.

The block diagram of the Boot Loader ISP process is shown in Figure 1-1.



Figure 1-1 Block Diagram of Boot Loader ISP Process

2 FEATURES

The NuTool – Boot Loader ISP Tool features are listed below:

- Save users time in developing ISP firmware.
- Provide a variety of connection interfaces: USB, UART, SPI, I²C and CAN.

3 SOFTWARE AND HARDWARE REQUIREMENTS

To use the NuTool – Boot Loader ISP Tool, software and hardware requirements are listed below:

NuvoISP_BL.exe

- Download NuvolSP_BL.exe from (<u>https://www.nuvoton.com/resource-download.jsp?tp_GUID=SW132022071806572776</u>).
- Prepare Nu-Link or Nu-Link2 with VCOM function or a USB-to-UART converter if UART ISP mode is selected.
- Prepare Nu-Link2-Pro if SPI, I²C or CAN ISP mode is selected. The three Boot Loader ISP modes require the Nu-Link2-Pro Bridge to convert the commands and data of the NuTool – Boot Loader ISP Tool into corresponding signals respectively, and communicate with the Boot Loader of the target chip. The overview of Nu-Link2-Pro is shown in Figure 3-1.
- Enable the appropriate Boot Loader ISP mode according to the application. Figure 3-3
 presents how to use Nuvoton's ICP Programming Tool to set Boot Loader ISP mode of
 M460 seres.

Note: For more information about Nu-Link2-Pro Bridge, please refer to Chapter 3 in *Nu-Link2-Pro Debugger and Programmer User Manual* (<u>https://www.nuvoton.com/resource-download.jsp?tp_GUID=UG1320200319174043</u>). Figure 3-2 shows the pin definitions of Nu-Link2-Pro Bridge Connector.



Figure 3-1 Nu-Link2-Pro Overview

nuvoTon

	Bridge Con	nector			
	ТΧ	CON6.1	CON6.2	RX	
I2C ———	SCL	CON6.3	CON6.4	SDA	
CDI .	SS	CON6.5	CON6.6	CLK	
581	MOSI	CON6.7	CON6.8	MISO	
	RS485_A	CON6.9	CON6.10	RS485_B	
CAN ──→	CAN_H	CON6.11	CON6.12	CAN_L	
	ADC	CON6.13	CON6.14	VCC33	
	PWM	CON6.15	CON6.16	VCC33	
nRST →	GPI00	CON6.17	CON6.18	GND	
	GPI01	CON6.19	CON6.20	GND	

Figure 3-2 Nu-Link2-Pro Bridge Connector

nuvoTon

🛹 Nuvoton Nu	Micro ICP Programming Tool 3.09 - M460 Series - 🛛 🕹 🗙
<u>P</u> roject <u>C</u> hips	<u>T</u> ool <u>O</u> peration <u>L</u> anguage <u>H</u> elp
nuva	lon
Status	Chie Connected with Nu Liek 2 (ID: 7700/2-0)
Disconnect	
Part No.	UID/UCID/XOM/OTP Key:
Load File	
APROM	
	File not load. Base: Ux UUUUUUUU Utitset: Ux U
Data Flash	File Name: C:\Data.hex
	File not load.
LDROM	File Name: C:\LDROM.hex
	File not load.
OTP	File Name: C:\OTP.otp
ВОТРК	File Name: C:\ROTPK.bin
SPI Flash	File Name: C:\SPIFlash.hex MFP
	File not load. Start: 0x 0 Cipher Key
	Size: 0x
Chip Settings	
Setting	Config 0: 0xFFFFFFF Config 1: 0xFFFFFFF < Update History >
	Config 2: 0xFFFF5454, Config 3: 0xFFFFFFF
	De havel Flack
Boot Loader ISP Mode	
CAN (PA. 4/PA.5)	CO/PC.1) - Select and enable Boot Loader ISP mode O 16 bits
SPI (PA.0/PA.1/PA.2/PA.3)	◯ 32 bits
	Refresh
Programming	
	Data Flash DDROM DTP Chip Setting Options Start
	ANK1 📋 ROTPK 🔄 SPI Flash

Figure 3-3 Set Boot Loader ISP Mode

4 USER INTERFACE GUIDE

4.1 Overview

When *NuvoISP_BL.exe* is executed, the NuTool – Boot Loader ISP Tool window will pop up, mainly including the Connection Interface selection, connection and chip information display, file loading, CONFIG settings, reset options and progamminmg options. The overview of the NuTool – Boot Loader ISP Tool is shown in Figure 4-1.

	💊 Nuvoton NuMicro Boot Loader ISP Programming Tool 1.00 – 🗆 🗙	
	ΠυνοΤοη	
	Connection Interface Status	Connect to target chip,
Connection interface —	Disconnected Disconnected Disconnected APROM: 1M, Data: 0K, LDROM: 9K	 display connection status
	Scan Polt V 113200 V 113200 Failed FW Ver: 0x22105001	and chip info.
	Load File APROM Write File:	
	File not load. Base Address: 0x 00000000	Load the files and specify the
	LDROM Read File:	start address for programming
	File not load.	
	Config Bits	
CONFIG settings —	Setting Config 0-3: 0xFFFFFFF 0xFFFFFFF 0xFFFF5A5A 0xFFFFE0FF	
Change Baud rate of	Clock Reset	 Reset Options
connection interface		
	File Data	
	8 bits	
	◯ 16 bits ◀	 Data display area
	() 32 bits	
Programming options —		- Start programming
riogramming options		Start programming

Figure 4-1 NuTool – Boot Loader ISP Tool Overview

4.2 Select Connection Interface

Before updating the target chip, the NuTool – Boot Loader ISP Tool needs to connect with Boot Loader first. There are five connection interfaces including USB, UART, SPI, I²C and CAN for users to select, as shown in Figure 4-2. Users can select the appropriate connection interface according to the actual product circuit.

Note: The three interfaces of SPI, I²C or CAN need to use with Nu-Link2-Pro Bridge function.



Figure 4-2 Connection Interfaces

4.2.1 USB Interface

If USB is selected as the connection interface, confirm whether the USB ISP mode is enabled. Then just connect the USB port of the target chip to the PC without any wiring.

	UART (PB.12/PB.13)	USB
Scop Port v 115200 v	CAN (PA.4/PA.5)	✓ I2C (PC.0/PC.1)
ScanPoit ~ 115200 ~	SPI (PA.0/PA.1/PA.2/PA.3)	



4.2.2 UART Interface

If UART is selected as the connection interface, confirm whether the UART ISP mode is enabled. Then the user can use the Nu-Link/Nu-Link2 VCOM function or the USB-to-UART converter on the market to connect with the UART interface of the target chip. The Nu-Link/Nu-Link2 VCOM or the USB-to-UART converter must connected to the pins specified by Boot Loader. Taking the M460 series as an example, the pins of UART interface are PB.12 and PB.13. Finally, select the appropriate COM port and baud rate to connect.



Figure 4-4 UART Interface

4.2.3 SPI Interface

If SPI is selected as the connection interface, confirm whether the SPI ISP mode is enabled. Then the user needs to connect the SPI interface (CON6.5~CON6.8) of Nu-Link2-Pro Bridge as shown in Figure 3-2 to the pins of the SPI interface specified by Boot Loader. Taking the M460 series as an example, the pins of SPI interface are PA.0, PA.1, PA.2 and PA.3.

Connection Interface		Boot Loader ISP Mode	
SPI	\sim	🗹 UART (PB.12/PB.13)	🖂 USB
		🗹 CAN (PA.4/PA.5)	I2C (PC.0/PC.1)
Scan Port \vee 115200	\sim	SPI (PA.0/PA.1/PA.2/PA.3)	



4.2.4 I²C Interface

If I²C is selected as the connection interface, please confirm whether the I²C ISP mode is enabled. Then the user needs to connect the I²C interface (CON6.3 and CON6.4) of Nu-Link2-Pro Bridge (as shown in Figure 3-2) to the pins of the I²C interface specified by Boot Loader. Taking the M460 series as an example, the pins of I²C interface are PC.0 and PC.1.

Connection Interface	Boot Loader ISP Mode
12C ~	
Scan Port \sim 115200 \sim	SPI (PA.0/PA.1/PA.2/PA.3)

Figure 4-6 I²C interface

4.2.5 CAN Interface

If CAN is selected as the connection interface, please confirm whether the CAN ISP mode is enabled. Then the user needs to connect the CAN interface (CON6.11 and CON6.12) of Nu-Link2-Pro Bridge (as shown in Figure 3-2) to the CAN transceiver on the board of target chip. And the pins of the CAN interface specified by Boot Loader must also be connected to the CAN transceiver. Taking the M460 series as an example, the pins of CAN interface are PA.4 and PA.5.





4.3 Connect with Boot Loader

Since Boot Loader has a time-out mechanism, the connection must be completed within a specified time after the chip is powered on. Thus, the user must click the "**Connect**" button first, and then press the reset button on the target chip board. Please repeat the previous steps if it is still failed to connect after waiting for a while.

In the following cases, the user can check the "**Reset before connecting**" option as shown in Figure 4-8 to improve the connection success rate.

- UART is selected as the connection interface, and Nu-Link/Nu-Link2 VCOM is used as the bridge.
- SPI, I²C or CAN is selected as the connection interface, and GPIO0 (CON6.17) of Nu-Link2-Pro Bridge as shown in Figure 3-2 is connected to nRST pin of the target chip.

If the connection is successful, the status prompt will change to "connected" and display the Part No., Flash memory size and firmware version of the Boot Loader as shown in Figure 4-9; otherwise, the status prompt keeps showing "Waiting for device connection", as shown in Figure 4-10.





tatus		
)isconnected Connected	Reset before connecting	
Part No. M467HJHAE	APROM: 1M, Data: 0K, LDROM: 8K FW Ver: 0x22105001	Display chip information and boot loader firmware version

Figure 4-9 Succeed to Connect with Boot Loader

Figure 4-10 Waiting to Connect with Boot Loader

4.4 Load File

Users can click the "**APROM**" and "**LDROM**" button or drag and drop to load the image file, and then specify the starting address of APROM programming. When the image file is loaded, the image data is displayed in the corresponding data display area (as shown in Figure 4-12).

Load File			
APROM Write	e File:		Select APROM file
	File not load.	Base Address: 0x 00000000	Specify the programming address
LDROM Read	d File:	•	Select LDROM file
	File not load.		



APROM LD	ROM																	
00000000: 00000010: 00000030: 00000040: 00000050: 00000060: 00000070:	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55 55	55 55 55 55 55 55 55 55	< >	 8 bits 16 bits 32 bits

Figure 4-12 Data Display Area

4.5 CONFIG Settings

When the NuTool – Boot Loader ISP Tool is successfully connected with Boot loader, the CONFIG values of the target chip will be displayed in green as shown in Figure 4-13. The users can click the "**Setting**" button to modify the CONFIG values. After comparison, if the modified CONFIG value is different from the original value, the modified CONFIG value is displayed in red, as shown in Figure 4-14.

Config Bits						-	
Setting	Config 0-3:	0xFFFFFFFF	0xFFFFFFFF	0xFFFF5A5A	0xFFFFE0FF	↓ CO	NFIG values of target chip
	UI for CONFIG settings					•	

Figure 4-13 CONFIG Settings

Config Bits Setting	Config 0-3:	0xFFFFFFE 0x000FF00	0 OxFFFF5A5A	0xFFFE0FF

Figure 4-14 Modified CONFIG Settings

4.6 Change the Baud Rate of Connection Interface

After the NuTool – Boot Loader ISP Tool is connected with Boot loader, the user can change the appropriate baud rate of UART or CAN interface according to the circuit capability to improve the transmission efficiency.



Figure 4-15 Change UART Baud Rate



Figure 4-16 Change CAN Baud Rate

4.7 Reset Options

The reset options are used to reset the chip and jump the chip to the specified reboot address. The reset options are executed after updating APROM, LDROM and CONFIG. There are 4 reset sources in the reset options, including:

- **CMD_RST_SRC_CHIP**: Assert the Chip Reset and the reboot address is ignored.
- **CMD_RST_SRC_CPU**: Assert the CPU Reset and reboot from the specified address.
- CMD_RST_SRC_SYS: Assert the MCU Reset and reboot from the specified address.
- CMD_EXEC_ADDR: Jump to the specified address without reset.

The reboot address must be 512-byte aligned.

For detailed information about Chip Reset, CPU Reset and MCU Reset, please refer to the "System Reset" section in NuMicro Series Technical Reference Manual.

Taking the M460 series as an example, the "System Reset" is described in Section 6.2.2 of the M460SeriesTechnicalReferenceManual(https://www.nuvoton.com/resource-download.jsp?tp_GUID=DA05-M460).

Reset			Ļ	 Specify the execution address of the user application code
Reboot Source	CMD_RST_SRC_C ~	Address: 0x	00000000	
	CMD_RST_SRC_CHIP CMD_RST_SRC_CPU CMD_RST_SRC_SYS CMD_EXEC_ADDR	•		- Select reset source

Figure 4-17 Reset Options

4.8 **Programming Options**

Before programming, the user can check the programming options according to their needs. The programming options include:

- **APROM**: Erase APROM and program APROM file data to the specified APROM address.
- **LDROM**: Erase LDROM and program LDROM file data to LDROM.
- **CONFIG**: Update CONFIG settings.
- **Erae All**: Erase whole APROM and LDROM.
- **Reset**: Execute reset options
- **Clock**: Change baud rate of connect interface. Only UART and CAN have this function.

• **USBDISP**: Switch to Boot Loader USB ISP mode. The premise is that USB ISP mode must be activated.

	Chart
	Stat
	 Switch to USBD ISP mode
	- Change Baud rate of connection interface
	- Execute reset options
	 Erase whole APROM and LDROM
	- Update APROM, LDROM and CONFIG

Figure 4-18 Programming Options

4.9 Programming

After loading the files for programming and setting the relevant options, click the "**Start**" button as shown in Figure 4-19 to start programming APROM, LDROM and CONFIG or execute commands of other options. After the programming is finished, a message showing the programming result and time will appear as shown in Figure 4-20.

Figure 4-19 Start Programming

NuvoISP_BL	×	
Programming flash, OK! (1 secs)		
ОК		

Figure 4-20 Programming Result

5 REVISION HISTORY

Date	Revision	Description	
2022.09.21	1.00	Initial version	



Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

Please note that all data and specifications are subject to change without notice.

All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.